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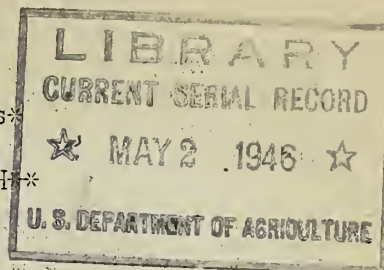
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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**

FEBRUARY 1946



EROSION CONTROL PRACTICES DIVISION

Soil Losses on Corn and Soybean Land Vary With Preceding Crop -

Dwight D. Smith, Columbia, Missouri. - "Corn land has allowed minimum erosion when following a grass and legume meadow during the 5 years of soil loss records at McCredie. During the 4-month period May through August, the average soil loss for corn following grass was 2.4 tons per acre in comparison to 4.6 tons following sweet clover under as a green manure, 6.6 tons following one year of corn with the stalks returned to the soil, 8.8 tons following a lespedeza hay crop, and 10.8 tons following oats in a corn-oats rotation without soil treatments.

"The annual soil loss from soybeans following corn has been high due to the lack of cover during the winter and early spring and also during the soybean growing period due to a poor soil condition. A plot to be in soybeans following corn lost 4.0 tons per acre during the first 4 months of the year in comparison to 0.3 ton from a meadow plot going to soybeans. During the next 4 months the former plot lost 4.5 tons per acre in comparison to 1.8 from the soybeans following meadow plot."

Field Cultivation Pasture Renovation Excels - Orville E. Hays,

IaCrosse, Wisconsin. - "Two years of results are available to determine the effect of renovation on soil and water losses and yield of pasture. The treatments were established in 1944 and in 1945 all plots were grazed. The following table shows the losses for the two years and the yields in 1945."

Treatment	Soil and Water Loss				Forage Yield in 1945
	1944		1945		
	Runoff	Soil Loss	Runoff	Soil Loss	
	Inches	T/A	Inches	T/A	
Field cultivator renovation	0.03	0.02	1.30	0.09	3.56
Spring plowed renovation	2.13	5.62	2.04	0.19	2.68
Bluegrass, grazed	0.96	0.09	2.05	0.20	1.00

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**All Research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

"The advantage of mulch as produced by the field cultivator continued during 1945 resulting in less runoff. There was about 60 percent as much runoff from plots worked with the field cultivator as compared with plots which were spring plowed.

"The stand of legumes was better on the plots renovated with the field cultivator and the plants more vigorous in growth which resulted in higher yields. The results of these studies and general renovation work on the Station would indicate that a good stand of legumes can be obtained without plowing and that, if equipment is used which will leave most of the leaf litter on top, soil and water losses will be low."

Wheat Tillage Methods and Protein Content - Carl L. Englehorn, Fargo, North Dakota. - "Although differences in the protein content of the crop of wheat harvested from plots tilled by various methods for seedbed preparation and for summer fallow are not great, a trend toward a lower protein content with increased surface mulch is indicated by the accompanying data for 1944 and 1945. Under continuous cropping at Edgeley, the protein content of wheat from plowed stubble was only about 2.4 percent higher than from stubble mulch tillage in both years. At Langdon, however, protein in wheat from plowed stubble was more than 10 percent higher than from stubble mulch tillage.

"At Edgeley plowed fallow produced wheat with 8 percent more protein than stubble mulch fallow during 1944; during 1945, the difference was very slight. At Langdon wheat from plowed fallow had 10.3 percent more protein during 1944 and 7.2 percent more protein during 1945 than wheat from stubble mulch fallow.

"At present premium prices based on protein content, tillage method has not affected the protein content of the 1945 wheat crop to the extent of any price difference at Edgeley. During 1944 the wheat from the plowed plot under continuous cropping with 13 percent protein would be worth two cents a bushel more than the wheat with lesser protein content from other tillage. Wheat from 1944 plowed fallow at Edgeley would carry a premium of four cents above wheat from stubble mulch fallow.

"Wheat from summer fallow has a much higher protein content than wheat produced under continuous cropping. At Edgeley, at present premium prices, wheat from fallow plots is worth eight cents a bushel more than wheat from continuous cropping."

"Protein content of wheat grown continuously and after summer fallow at Edgeley and Langdon, North Dakota, 1944-45 average

Tillage Method	Edgeley, N. D.		Langdon, N. S.	
	Continuous wheat	Wheat after summer fallow	Continuous wheat	Wheat after summer fallow
Protein Content of Wheat, Percent				
Moldboard plow	12.9	15.5	10.7	13.7
Field cultivator	12.4	15.0	10.0	13.2
Subsurface tiller	12.6	14.8	9.6	12.6
Disk	12.3	--	--	--
Oneway, fall	--	--	10.5	--

Rotations With Green Manure Crops Reduce Soil Loss - Glenn M. Horner, Pullman, Washington. - "Erosion conditions in the Palouse region are very severe this year. On the basis of records from a series of plots established in 1931 and from an examination of photographs taken in different sections of the region since 1931, it appears that the erosion conditions at the present time are more severe than any other year since the winter of 1933-34. The amount of erosion is quite variable in different sections, and is correlated with the degree of adoption of conservation practices and also with variations in the amount and intensity of precipitation.

"The effect of the cropping system on runoff and soil losses is shown by results obtained on the crop rotation plots during December. The data given below are losses from plots seeded to winter wheat following different crops.

Treatment	December, 1945, losses	
	Runoff	Soil loss
	in.	Tons/A
Winter wheat after summer fallow	1.05	35.0
Winter wheat after peas	0.58	21.8
Winter wheat after sweet clover as green manure (5-year rotation)	0.36	14.9
Winter wheat after peas as green manure	0.27	11.8
Winter wheat after Hubam clover as green manure	0.29	14.3
Winter wheat after spring wheat (8-yr. rotation)	0.19	5.5

"The most severe erosion losses occurred on the summer-fallowed plot compared to land cropped in 1945. Rotations in which legumes were used as green manure crops showed a marked reduction in erosion. The most effective treatment was the 8-year alfalfa rotation consisting of 4 years of alfalfa - grass, spring wheat, winter wheat, peas, and spring wheat."

Surface Residues, Insects and Disease - Maurice Donnelly, Riverside, California. - "One of the problems in the wind area, northwest of Riverside in Riverside and San Bernardino counties, concerned the effect of stubble mulch on the insect populations in grape vineyards. The view appears to be prevalent among the grape growers that residues at the surface of the ground increase damage to the vines from cutworms and leaf hoppers by setting up a condition favorable for the increase of these pests. Dr. A. L. Boyce, head of the Division of Entomology of the Citrus Experiment Station, states, however, that in his opinion the presence of such surface organic residues should not cause an increase in these insects.

"A similar question arose in connection with the management of vine residues from tomatoes grown dry-farm on sloping lands in the Santa Barbara Coastal Soil Conservation District. Here the tomato growers have been following the practice of buck-raking the vines from the land and dumping them into a nearby gully or low place. These vines, if left on the land would make excellent stubble mulch. Tomato growers have thought that if they were left they might cause an increase in tomato diseases in the succeeding tomato crop. Dr. John T. Middleton, plant pathologist of the Citrus Experiment Station, who specializes in tomatoes and other truck crops, concludes as follows: Bacterial canker is the principal disease to be on the watch for. If the vines are healthy, no increase in disease should be expected in the succeeding tomato crop from the incorporation of the

vines into the soil in the manner that conservationists recommend (that is gradually, in order that there is surface protection in the early and middle part of the winter). If the vines are not healthy, tomatoes should not be planted the following year anyway."

Advantage of Crested Wheatgrass - H. L. Thomas, Corvallis, Oregon.- Preliminary consideration of the costs of wheat farming and the effects of soil erosion on wheat yields on different land slopes shows the following points of advantage for growing crested wheatgrass instead of wheat.

- "Gentle slopes--Advantage favorable to grass on 3 bushel land.
- Moderate slopes--Advantage favorable to grass on 11 bushel land.
- Steep slopes--Advantage favorable to grass on 14 bushel land."

These advantages for crested wheatgrass are in addition to its use in small areas to improve the shape of fields and facilitate contour cultivation.

Loss of Soil Nitrogen on Wheat Land - Hugh C. McKay, St. Anthony, Idaho.-"The loss of nitrogen from our soils at the Experiment Station was very rapid for the 5-year period from 1939 to 1943. The following table gives some of the nitrogen losses for the five-year period. Three fallow years and two crop years occurred during this period.

<u>Initial Tillage Method</u>	<u>Loss of Soil Nitrogen from 1939 to 1943</u> Pounds per acre	
	<u>Straw Utilized</u>	<u>Straw Burned</u>
Moldboard plow	160	240
One way disk	220	220
Subsurface tillage	200	160
Average	193	207
One way disk + 75 # Am. Sulph. Time of Plowing	160	
One way disk + 2000 # Straw	80	
One way disk + 4000 # Straw	120	
Continuous winter wheat	200	

"Straw burning caused a greater nitrogen loss in the moldboard plowing plots, but not in the one way disk or subsurface tillage plots. It was expected that straw burning would show a greater loss for all types of tillage.

"The application of 75 lbs. ammonium sulfate at time of seeding decreased the nitrogen loss from an average of 44 pounds per year to 32 pounds per year. The application of straw also decreased the loss of soil nitrogen still further, but it was expected that the 2 ton application would show less loss. The continuous wheat plots showed a total loss of 200 lbs. for the 5 year period or an average of 40 lbs. per year.

"It is expected that a 35 to 40 bushel wheat crop will take out at least 50 lbs. of nitrogen per crop. Figuring on this basis, there is an unexplained loss of 100 lbs. of soil nitrogen for this 5 year period, as only two wheat crops were taken off. This loss was due either to erosion or to percolation into the soil below sampling depth.

"While these soils are relatively high in soil nitrogen, .168, the decrease from .178 in 1939 to .168 in 1943 is very serious. If this rapid loss of soil nitrogen continued, the nitrogen would be exhausted in approximately 30 years. Only about 25% of our dryland soils in this area have as high a soil nitrogen percentage. The rest of the dryland soils run about 50% less. It is quite evident a sound conservation program is needed if the productivity of our dry-land soil in southeastern Idaho is to be maintained."

Increased Growth on Contour-Furrowed Range Land - Bruno Klinger, Fort Collins, Colorado.-"Although less beef was produced in the contour-furrowed native pastures in 1945 than in 1944, the amount of grass produced in 1945 was larger than in the preceding year. Yield data are taken from plots laid out across contour furrows and from similar plots laid out in unfurrowed areas included in the treated pastures. In part the increased production in 1945 consisted of flower stalks, which were, as usual, little grazed after they had matured. Data for the last two years are as follows:"

Item	Unfurrowed		Furrowed	
	1944	1945	1944	1945
Grass produced, pounds per acre	205	194	212	265
Grass used, pounds per acre	101	105	108	151
Grass used, per cent	49	54	51	57

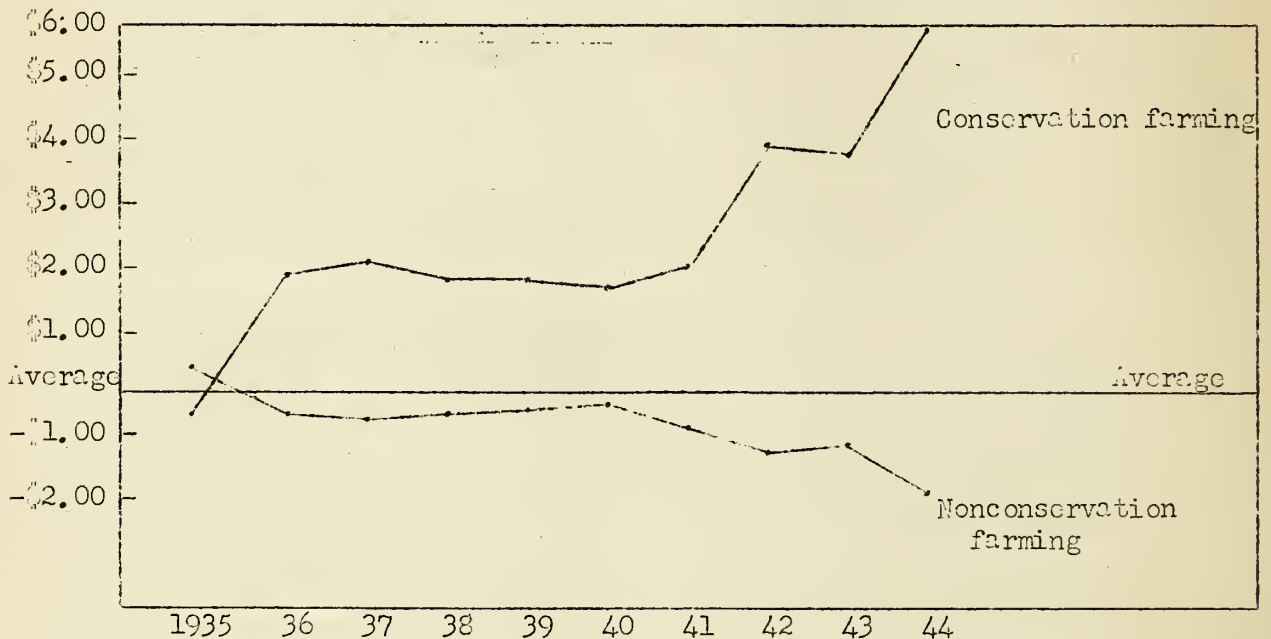
Winter Legumes Respond to Phosphate - H. O. Hill, Temple, Texas.-"Of the 24 winter legumes planted in October 1945 a number of them are responding to phosphate fertilizer. The legumes showing most response are as follows in descending order: Hubam clover, melilotus indica, bur clover, emerald clover, Canadian field pea, lappacea clover, ladino clover, white dutch clover, and Louisiana white dutch clover. No response is evident on Austrian winter pea, dixie wonder pea, singletary pea, creole pea, willamette vetch, hairy vetch, alfalfa, madrid clover, biennial white sweet clover, and hop clover. Poor stands were obtained from alsike, bluebonnet, and birdsfoot trefoil. These three may be adapted to this area. Crimson clover has shown definite nutrition disorders and is not adapted to the high line soils in this area. Blue lupine has been shown 100% kill from 20° temperature and therefore is not adapted to this area."

"Good Austrian winter pea and creole pea growth was obtained on bedded land. This leads us to believe that the peas and vetches will do much better on bedded land, particularly when the legume is planted on the ridge to provide better drainage. The peas and vetches reported on in the above paragraph were flat planted which may be the reason for poor growth and lack of phosphate responses. Austrian winter peas on bedded land are showing high responses to phosphate fertilizer."

Only The Rich Can Afford Nonconservation Farming - E. L. Sauer, Urbana, Illinois.-"It takes three to eight years of benefits to pay for the costs of a conservation program. Those who do not adopt such a program will

find that their earnings will steadily decline. Farm records show that the spread in earnings between good and poor farming is becoming wider. Note the nine-year trend in net income from conservation farms in McLean County, Illinois."

Difference in Net Income, Per Acre, Conservation and Nonconservation Farms, McLean County, Illinois, 1935-44



Which Road Are You Taking?

January Runoff Varies With Condition of Soil Surface and Cover -

George W. Hood, Batesville, Arkansas.-"Analysis of the runoff during the month of January from four well-defined storms ranging from .51 inch to 2.37 inches provide some comparisons of runoff by ground cover conditions. The following table gives the number of inches of rainfall lost under the several conditions for each rain, and the total number of inches lost for the month.

Condition of Plots	Date and Inches of Rain				
	1/4	1/7	1/10	1/19	Total
	.86"	2.37"	.51"	1.06"	4.80"
	Inches of Runoff				
Plowed rough ground	.015	.340	.044	.051	.35
Fall oats broadcast	.116	.736	.336	.356	1.54
Bermuda grass	.004	.104	.001	.002	.115
Bare cotton ground up and down slope	.178	.712	.267	.273	1.42
Bare cotton ground contoured	.020	.707	.183	.029	.84

"Bermuda grass pastures lost only .115 inches out of a total of 4.80 inches. Fall plowed ground, which was allowed to remain rough as it was plowed, lost only .35 of an inch out of a total of 4.80 inches. The fall plowed ground absorbed and retained 4.45 inches of the total of 4.80 inches. This added supply is stored up in the soil for future use of the growing crops. The fall grown oats and the bare cotton ground left in the condition of the last cultivation last year are both on a 4% slope. From each of these plots about the same amount of rainfall was lost by runoff, namely 1.54 inches for the fall planted oats and 1.42 inches for the bare cotton ground. The amount of soil carried away was slightly less on the oats than on the bare ground, but it was evident that the fall planted grains are not very effective in retaining winter rains, although they do help to hold some soil.

"Contrasting the bare cotton ground planted up and down the slope with that of cotton ground listed on the contour, reveals a decided advantage in moisture saving during the winter on the contour listed ground. On a 4% slope the contour listed ground lost .84 of an inch of rainfall while the plots that were not contoured lost 1.42 inches out of a total of 4.80 inches. A consideration of these losses over a long period makes it apparent that the condition of the ground over the winter is a very important factor in the production of profitable crops."

Soil Moisture in Wheat Fields - C. J. Whitfield, Amarillo, Texas.-

"With warm weather, wheat made good growth during the month and is rapidly depleting the small amount of stored moisture. The rapid growth has furnished a good cover on most fields and wind erosion should not occur. No damage by wind erosion has occurred on wheat fields at the station. September-seeded wheat on fallow has been in good condition for grazing and September-seeded wheat on wheat-after-wheat culture has been in fair condition for grazing. October-seeded wheat has not furnished grazing. The available moisture, root depth, and cover condition are given for three wheat fields and one fallow area with stubble-mulch tillage:

Crop	Date of seeding	Available moisture in upper 4 ft.	Root Depth	Ground cover
	<u>Month</u>	<u>Inches</u>	<u>Inches</u>	<u>Per cent</u>
Seeded wheat on fallow	Sept.	2.29	31	50
Seeded wheat after wheat	Sept.	1.88	25	20
Seeded wheat after wheat	Oct.	2.81	16	12
Wheat stubble mulch.	--	3.57	--	20

"The late seeded wheat fields have the most available moisture at this time. However, with severe wind conditions, they are more likely to be damaged by wind erosion. The early seeded wheat should deplete the moisture supply in from three to four weeks. Under good moisture conditions, available moisture in the upper four feet should be approximately five inches at this date. With the exception of the late seeded wheat, the plants are well rooted and are rooted deep enough to use most of the stored moisture."

Grazing Lands Low in Moisture.—"The cool-season grasses started growth during the month. By the end of February, crested wheatgrass and western wheatgrass had from 2-1/2 to 3 inches of new growth and Canada wild-rye, 1-1/2 inch. Precipitation has been much below normal and little barley, an annual grass that usually starts growth at this time and furnishes early spring grazing, has had a very limited germination.

"Soil moisture samples, taken on five pastures on February 28, show the low reserve of available stored moisture as follows:

Type of Pasture	Depth Sampled				Total in upper 3 ft.
	0-6"	6-12"	12-24"	24-36"	
	(Inches of Available Moisture)				
Native blue grama-buffalo Moderately grazed	.56	.58	.71	.23	2.08
Native blue grama-buffalo Heavily grazed	.57	.45	.46	.25	1.73
Mixture-Reseeded Warm- and Cool-season Grasses	.42	.34	.61	.33	1.70
Western wheatgrass	.54	.22	.43	.27	1.46
Crested wheatgrass	.46	.29	.59	.43	1.77

"Under good moisture conditions, approximately 4.00 inches of available moisture should be present on pasture land at this date. Also, one-half of the available moisture is in the first 12 inches which makes loss from evaporation high. Without normal moisture in March and April, the outlook for high forage yields of the cool-season grasses is poor."

High February Precipitation - Russell Woodburn, State College, Mississippi.—"February rainfall of 8.98 inches was the highest since the all-time record of 9.51 inches in 1939, and the fifth highest in 58 years of record for the month. This precipitation following 9.25 inches in January brings the years total as of March 1 to 18.28 inches or the highest of record.

"This rainfall resulted in widespread floods and damage to fields and the highways. U. S. 82 at Columbus, Miss. was closed from Feb. 11 to 16 (the second time in 1946) on account of highwater from the Tombigbee River.

"Only moderate erosion was noted for the heavy February rainfall on the bare plot and virtually no soil loss on plots protected with vetch or with woods and corn crop trash."

Corn Production in South Carolina - T. C. Peele, Clemson, South Carolina. - "During 1943 and 1944 yields of corn on plots where corn follows winter legumes each year averaged about 30 bushels per acre. One of these years was a good corn year with adequate moisture and the other year the corn suffered considerably in dry weather. When adequate moisture was present no significant differences were found between mulch culture and clean tillage. In the moisture deficient year the mulch culture gave significantly higher yields than the clean tillage methods, but all yields were lower than we consider to be desirable.

"In 1945 an attempt to lift the general level of the corn yields on all plots resulted in some quite spectacular yields for eroded Cecil sandy loam. The yields averaged about 80 bushels per acre from our mulch disk treatments and our plowed clean cultivation treatments. Adequate moisture was available throughout the corn growing season and there was no significant difference between the yields of these treatments. A hybrid seed corn, Funks G714, which had shown up well in variety tests at Clemson was planted on the plots with about 18" spacing in 42" rows. The corn was cultivated twice before the corn became too tall for cultivating it with a tractor. Corn received 500 pounds of 3-9-9 fertilizer applied in a band 2" to the side and 2" below the seed at planting time. It was side dressed with cal-nitro equal to 45 pounds nitrogen per acre, at the second cultivation when the corn was about 3 feet high. All of the tillage operations on these plots were performed with tractor equipment.

"The entire burden of the low 14 bushel average yields in South Carolina can not be placed on the lack of sufficient nutrients, but must be partially attributed to moisture relations and the use of poor planting seed. Several workers have reported in recent years that certain hybrid corns are more resistant to drought than open pollinated varieties. It appears to us that this is quite possibly true as the hybrid corn that we planted certainly had a more vigorous root system than any of the open pollinated varieties I have seen."

Wind Erosion Removes Fine Soil Particles - O. R. Neal, New Brunswick, New Jersey. - "Each year in early spring there is evidence of considerable soil movement through wind action, particularly on the Coastal Plain areas. Wherever the soil has been fall-plowed or left without a winter cover crop, wind erosion takes place to a greater or less extent. This has been evident during the month just past. On an unprotected plot area at the Marlboro station, the best measurements that could be made at the moment indicated that about one-fourth inch of soil had been removed. This measurement was roughly substantiated by the dune of coarse material collected in the adjoining vegetated area.

"At another location near Freehold samples were taken from the surface of a fall-plowed field and also from a dune of coarse material that had formed at a snow fence in the field. The surface soil was made up of 47 percent sand, 35 percent silt, and 18 percent clay. The material deposited after movement by the wind contained 80 percent sand, 16 percent silt, and 4 percent clay. More than 60 percent of the fine particles in the soil moved by wind action were carried off the field. It has been shown in earlier reports that plant nutrient materials are associated with the fine particles. Both wind and water erosion tend to remove fine particles more rapidly than coarse particles. As either or both processes continue the surface soil tends to become more sandy,

and accordingly, more susceptible to wind erosion. Wind erosion on these areas can be easily controlled, at least until planting time, by the use of winter cover crops."

Tobacco Row Grades - T. L. Copley, Raleigh, North Carolina. - "A paper, entitled 'Row Grades and Row Layouts for Bright Tobacco Fields', was included in the Scientific Journal series of the North Carolina Experiment Station as Article No. 228."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"Rainfall for the month totaled 3.86 inches - falling on 10 days. On each of 2 days, February 13 and 26, 1.2 inches of rainfall was recorded. Five-minute intensities were 0.4 and 0.8 inch per hour respectively. Runoff on the 2-acre wheatland watersheds for these 2 days are given below:

Watershed: Land		Runoff, Feb. 13		Runoff, Feb. 26		Remarks
No.	slope	Total	Peak rate	Total	Peak rate	
	Percent	Inches	Inches per hour	Inches	Inches per hour	
109	12.7	0.19	0.07	0.14	0.07	Well drained soil
115	6.6	.26	.09	.45	.26	Poor drained soil
123	5.8	.18	.07	.70	.24	-do-
128	13.6	.52	.12	.75	.32	Seepage flow

"Total runoff from a 75-acre mixed-crop watershed on these 2 days was 0.32 and 0.39 inch. The presence of frost in the ground and high soil moisture were major reasons for high percentage of runoff on February 13 and 26. Soil loss on this date for the above watersheds totaled 18, 185, 170, and 194 pounds per acre in the order listed in the table. Note that the February 26 runoff for watersheds Nos. 123 and 128 is at least 50 percent greater than that for No. 115. Yet the erosion was about the same. The former two watersheds were top dressed with manure. No. 115 was not. Much of the runoff from Nos. 123 and 128 came from seepage flow. The peak flow rates on all three watersheds were not materially different.

"Soil-loss data on the 26th, were obtained by the use of the inclined-axis silt sampling wheels. These wheels were installed this month on watersheds 115, 123, and 128. A plan is being worked out whereby the 'chart changers' for the runoff stations can service the 'wheel sampler' on the same trip. Considerable saving of labor and time is thereby attained.

"A manuscript entitled 'A Summary of Percolation and Other Hydrologic Data Obtained from the Coshocton Monolith Lysimeters' was approved for presentation at the SSSA meeting and its subsequent publication in the 'Proceedings' of the Society. This paper was presented in Columbus on February 27."

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.--"Runoff samples were collected and analyzed for three storms occurring during the month. Total losses of soil, organic matter, and nutrient elements have not been computed, pending compilation of the runoff totals. However, some interesting comparisons in the concentrations of these soil materials in the runoff are included in the following table:

Table 1.--Concentrations of Total Solids, Organic Matter, and Nitrogen in Runoff, February 13, 1946
Purdue Throckmorton Farm, Lafayette, Ind.

Crop	Treatment	1/ Watershed: Losses, pounds per acre-in of runoff			
		No.	Total solids	Organic matter	nitrogen
Fallow (Corn in 1945, stalks down)	Prevailing	10	365	19	1.8
	"	15	802	34	2.6
	Conservation	18	294	13	1.3
		14	172	9	.9
Meadow (2nd Year)	Prevailing	5	30	2	.3
	"	8	21	1	.3
	Conservation	6	36	6	1.3
		7	41	6	1.2

1/ Corn, wheat, meadow rotation, 'square' tillage and seeding, common (light) fertilization on 'prevailing' practice watersheds; same rotation contour seeding, heavy fertilization, and manure plowed under for corn, heavy fertilization, and manure top dressing of wheat on conservation-treated watersheds; 1st year of 2d rotation under differential treatment.

"Data for watersheds in new meadow (wheat in 1945) are similar to those included in the table for 2d year meadow. They show little effect of differences in treatments on the concentrations of those materials in the runoff, except for substantially higher concentrations of nitrogen from the conservation-watersheds in the latter case resulting from their recently having been top dressed with barnyard manure. There would appear to be significant effect of previous treatment on the concentrations in runoff from the fallow watersheds, following 1945 corn. Total losses were substantially affected by treatment in all cases."

Hydrologic Studies - R. G. White, East Lansing, Michigan.-"There were two periods of runoff at Watershed 'A', and four periods at Watershed 'B'. All runoff was caused primarily by melting snow. Runoff figures for the month are shown in the following table:

Date	Cultivated Watersheds			Wooded Watershed	
	Precipitation	Runoff		Precipitation	Runoff
		'A'	'B'		
	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>
Feb. 5-6	0.04	0.0239	0.0906	0.03	0
Feb. 8-9	0	.0074	.0351	0	0
Feb. 12-13	.88	0	.0112	1.07	0
Feb. 16-17	T	0	.1509	T	0
Total for Month	1.45	0.0313	0.2878	1.94	0
Percent runoff		2.16	19.85		0

"It will be noted that there is considerable difference between Watershed 'A' and Watershed 'B' in the percent of runoff. This difference is due to the difference in topography of the two watersheds. Watershed 'B' averages about 6.5 percent slope and is quite uniform in slope, while Watershed 'A' has an average slope of 6.0 percent, with a sizeable area just above the runoff measuring station with practically no slope. Snowfall on February 11 and 13 was quite heavy, and as a result, much water which ran from the upper slopes of Watershed 'A' was trapped or 'ponded' in this flat area of loose snow. Subsequent runoff for March should show considerably more runoff from Watershed 'A' due to the eventual liberation of this trapped runoff water. There was no soil loss from the periods of runoff, all runoff water being very clear as it passed through the silt box.

"On February 1, soil was frozen to a depth of 9 inches, and by February 3, frost had penetrated to a depth of 12 inches. There was no frost disappearance during the month, with frost remaining at a depth of 12 to 15 inches for the remainder of the month."

Hydrologic Studies - John Lamb, Jr., Ithaca, New York.

"February was not only dry but cold. The precipitation of 1.86 inches was approximately 9 percent below the 10-year average of 2.04 inches. However, 1.42 inches of this occurred as a snowfall of 11.75 inches. The average monthly mean temperatures of 20 degrees F was 6 degrees below the last 3-year average. On account of the sparse snow cover, soil was frozen to a depth of 4 inches in the woods, to 8 inches in the open areas.

All of these factors reduced runoff to zero in the woodland area, and a light runoff from the idle land in weeds on the 27th due to a 0.66-inch rainfall."

Microbiological Studies - F. L. Duley, Lincoln, Nebraska.-

"Work was started in the greenhouse to determine the effect of straw on germination and early development of corn plants. Conditions have been set up where this type of organic matter may affect germination. This is in an effort to explain a few cases where other workers have found stands of corn to be affected adversely where residue was left on the surface or mixed in by disking. Types of microorganisms occurring on or near the germinating seeds and the young plants are being determined."

Microbiological Studies - D. A. Parsons, Auburn, Alabama.-"The facilities of the soil-physical laboratory of the Alabama Agricultural Experiment Station have been utilized in connection with a special research project requested by the War Department to assist actively and in a consultant capacity with problems related to mud performance of military vehicles. The soil-physical equipment designed for fundamental studies in relation to implement design is being used for test work in connection with tank and military wheel-vehicle design. The most significant results obtained to date include the development of a formula for computing tractive effort of a tank under different soil conditions on the basis of soil shear resistance and vehicle weight. By means of this formula it is possible to predict the ultimate tractive efficiency of a track-laying vehicle within fairly close limits. Compression and arch action studies with model grousers (lugs) revealed important design factors with regard to shape and size of grousers. It was found that the maximum compression produced by a grouser depends upon the projected area in contact with the soil rather than the shape of the grouser. Model tests on grouser spacing revealed that tractive effort of a vehicle is in direct proportion to the total shear area of the track and the ground pressure produced by the weight of the vehicle. On the basis of these tests it could be shown conclusively that the height of the grouser height is of considerably less importance than was previously believed by track designers.

"A 1-year preliminary study on the Alabama Experiment Station cropping-system plots at Belle Mina, Ala., was initiated for the purpose of evaluating the physical changes taking place in the soil under different cropping systems and tillage treatments. Samples are being taken at regular intervals of approximately 1 month over a period of 1 year in order to determine the seasonal fluctuations. Samples are obtained from two depths with four cores at each depth by the sampling method of Lutzl/. The newly adopted sampling technique necessitated changes in the original design of the air-pressure pycnometer. With this new method it is possible to obtain an accuracy of ± 0.3 cc or approximately 0.4 percent of the total volume of the soil core. Results obtained to date indicate that the sampling technique permits sampling of soil cores without compression. It was also found that the effect of compression

within the soil core when obtained by the usual sampling methods may completely obliterate any treatment effects on soil porosity. A combination of the tension method² and air-pycnometer method permits the determination of unsaturation of the saturated sample without the necessity of saturating the under vacuum. Since the results obtained from porosity determinations³ to date do not include sufficient cropping and tillage treatments, no correlation of physical changes has as yet been attempted."

1/ J. S. Lutz, Raleigh, N. C., Unpublished data.

2/ Leamer, R. W., and Shaw, Byron, Am. Soc. Agro. Jour., 33, 1941.

3/ Kummer, F. A., and Cooper, A. W., Agr. Eng. (Vol. 26, No. 1, pp.21-23, January 1945)

Runoff Studies - N. E. Minshall, Madison, Wisconsin. - "For Fennimore, precipitation for January was 2.26 inches as compared with the normal of 1 inch. Of this amount, 1.46 inches occurred as rainfall on the 5th from 1:40 a.m. to 8 p.m. This storm was preceded by 0.30 inch of rain from 10 a.m. to 2 p.m. on the 4th, all of which was absorbed by a snow cover which averaged in depth from 10 to 12 inches. The observer checked the watershed at 4:30 p.m. on the 4th and found no runoff at that time. The observer's next visit was made at 10 a.m. on the 5th, at which time most of the snow had disappeared. Because there was no runoff on the afternoon of the 4th, and weather conditions did not indicate the possibility of runoff during the night, the runoff stations were not placed in operation until 10 a.m. on January 5.

"The total rainfall from 1:40 a.m. to 10 a.m. on January 5 was 0.64 inch. The total rainfall from 10 a.m. to 4 p.m. was 0.75 inch and the runoff during this same period was 0.77, indicating that there was probably 100 percent runoff during the latter part of this storm, owing to the frozen soil conditions. Rates of runoff at 10 a.m. were the same as at 4 p.m. The rate of runoff at 10 a.m. was about 0.10 inch per hour, but the rainfall for the preceding 2 hours averaged only 0.07 inch per hour, showing that there was still some runoff from melting snow at 10 a.m. The total runoff after 10 a.m. was about 0.90 inch. The total runoff for the day was probably 100 percent of the rainfall, plus a portion of the stored snow. The soil thermograph record shows the ground was frozen to at least a depth of 12 inches. The air temperature was constant at 34° at 8 p.m. on January 4 to 10 a.m. on January 5, and then rose gradually to 40° at 4 p.m. The maximum rate of rainfall between 10:40 a.m. and 11:20 a.m. was 0.30 inch per hour, while peak rates of runoff from the various watersheds ranged from 0.18 to 0.25 per hour at 11:30 a.m. The rain and melting snow on the 5th combined to produce peak rates of runoff on southwestern Wisconsin streams which were higher than any previously recorded. Temperatures at Fennimore varied from a maximum of 40° on the 5th to a minimum of -17° on the 26th."

Hydraulic Studies - D. A. Parsons, Auburn, Alabama.-"Exploratory hydrologic measurements on one farm pond and its watershed were continued. This pond has an area of 1.5 acres at spillway elevation and a watershed of about 28 acres. The watershed is terraced. The surface soil is generally sandy, but in many places erosion has resulted in the exposure of a micaceous, sandy clay quite commonly found in the lower Piedmont. The land use is mixed, varying from truck crops to trees.

"The relation between the flow of watershed ground water to the pond and time, during periods without ground-water accretion, appears to agree with the relation given by Dr. R. E. Horton for base flow originating from hillside aquifers: Introducing into his relation the obvious factor, kinematic viscosity, which varies about 30 percent throughout the year at this location, the expression for ground-water flow to the pond, Q , is as follows:

$$\begin{aligned} Q_2 &= Q_1 e^{-(k/u)(t_2 - t_1)} \\ &= (k/u) S_1 e^{-(k/u)(t_2 - t_1)} \end{aligned}$$

where: t = time

u = kinematic viscosity

S_1 = the amount of stored ground water available to the pond at time, t_1 .

When the pond inflow is expressed in inches depth per day, the value of k for this watershed is 0.20×10^{-5} .

"This relationship appears to be materially altered during the time of year when the valley vegetation is drawing heavily upon ground water for transpiration."

Hydraulic Studies - Vito A. Vanoni, California Institute of Technology, Pasadena, California.-"The preliminary report of tests of Lake Wedington Spillway was completed and ready for reproduction. Tests were completed on Lake Coffee Mill Spillway Plan IV. The model of this structure was tested both with a flat floor and a crowned floor. By crowning it was possible to improve the distribution of flow and to obtain a more satisfactory performance of the stilling basin.

"A model of the Rock Eagle Spillway at Eatonton, Ga., was installed in the model basin and preliminary tests made. The inlet to this structure is very asymmetrical, resulting in an extremely disturbed flow in the structure. The chute, which is trapezoidal in shape, also has a curve in it which introduces further waves and disturbances in the flow. The problem of the Laboratory is to correct these undesirable conditions."

Sedimentation Studies - Carl B. Brown, Washington, D. C. - "In the Central Valley, Calif., investigation of reservoir silting being made for the United States Army Engineers, surveys were completed during January and February on East Park and Stoney Gorge Reservoirs which store water for irrigation on the Orland Project of the Bureau of Reclamation. Reconnaissance-conservation surveys were completed above these reservoirs and on all the area above the Iron Canyon Reservoir site. Computation of data was continued. During the latter part of February, I made an inspection of the project in connection with the transfer of Mr. Louis M. Glymph, Jr. to Region 1 and the assignment of Dr. Eldon M. Thorp to take charge of the work. Plans for completion of the work were revised in conference with the staff of the District Engineer Office, and the date for completion of the project was extended until September 1, 1946.

"A report on the investigation of stock-pond silting in the Land Utilization Project near Pierre, S. D., was submitted to Regional and State officials for review.

"A survey of sedimentation in the municipal water-supply reservoir at Greensboro, N. C. was initiated at request of the city. The city is furnishing a survey party, and Mr. Gottschalk is supervising the work. He spent 1 week at Greensboro getting the survey started and plans to spend another week there when sediment measurements are undertaken.

"During this period I prepared an article on 'Sedimentation and Its Control' for the 1943-47 Yearbook of Agriculture, and a paper on 'Erosion Control on Watershed Lands' to be presented before the Annual Convention of American Water Works Association at St. Louis, Mo., on May 9."

Sediment Studies - Vito A. Vanoni, Cooperative Laboratory, California Institute of Technology, Pasadena, California. - "Results obtained from sediment-transportation studies in the 10-inch flume with different size sand were not in agreement. It seems possible that the reason for the disagreement can be attributed to the different amounts of sediment that are carried in suspension. These recent experiments showed that it is necessary to study this problem further. This problem is important because it deals with the high rates of transportation which are found in many natural streams which the Soil Conservation Service is called upon to control.

"Progress was made on the development of analytical expressions for the amount of material transported in suspension. This work involves the evaluation of two integrals that cannot be integrated by ordinary means. These integrals are being evaluated by numerical methods and the functions tabulated. The analytical expressions for the material in suspension are based on the relationships for the distribution of suspended material which were shown to apply by previous studies of this Laboratory.

"A paper was prepared on thermal density currents at Shaver Lake and was presented to the Sacramento meeting of the American Geophysical Union on February 27 by Mr. H. S. Bell. The paper was prepared for oral presentation only. The plan is to prepare a manuscript for publication in the Proceedings of the meeting."

Drainage Studies - Lee D. Dumm, Athens, Georgia.-"The evapotranspiration method of determining moisture storage in soil and determining dates when supplemental-irrigation water should be applied was worked up for the year 1944 at Athens, Ga. This computation shows that a 2-inch application of water should have been applied on June 3, June 25, July 7, and July 30 and that an application during the first week in October would materially have helped fall vegetables and the germination of small grain.

"Several days were spent looking over the 2,000 acres of land owned by the University to determine the most feasible area for the supplemental-irrigation project location. A suitable area was located on the Poultry Farm."

Drainage Studies - D. G. Miller, St. Paul, Minnesota.-"During this period we completed the 'Report of Working Committee on Sulfate Resistance Based on the 1945 Lean Mortar Bar Tests.' A copy of this report together with a 'Proposed Tentative Method of Test for Sulfate Resistance of Portland Cement' was sent to the Washington office."

Drainage Studies - Ellis G. Diseker, Raleigh, North Carolina.-"After the completion of a detailed soil survey, by the aid of soil specialists, two areas of the most uniform Bladen silt-loam soil was selected for the drainage experiment. One of the areas is located near Bethel, N. C., and will comprise approximately 55.0 acres for the experiment. The other area is located on the Plymouth Test Farm, near Plymouth, N. C. and comprises 46.6 acres. It was decided to concentrate efforts on the two farms and attempt to get the drainage experiments installed at these points as quickly as possible, and preferably before planting time this spring."

Drainage Studies - B. S. Clayton, Belle Glade, Florida.-"On January 22 pumping tests were made on a 10-acre square near 15 mile dike on the North New River Canal. The water level inside and outside of the dike at each of the four corners was measured each half hour from 10:30 a.m. to 5:30 p.m. At 3:30 p.m. the measurements showed that the water levels had reached a practical balance indicating that the seepage inflow was equal to the pump discharge and pumping was then stopped.

"At this time the average difference between the inside and outside water was approximately 8 inches or 0.67 foot and the water on the outside was practically at ground level. The discharge of the pump was 1.02 second feet. This was also substantially the seepage inflow."

"Under a 2.0 foot difference in head in this section of the 'Glades, it is estimated that the corresponding seepage inflow would be three times as great or 3.06 second feet. It is also estimated that the inflow into a diked area is proportional to the length of the enclosed dikes. Thus the seepage inflow into a section of land would be eight times as great as that into a 10-acre square and for a difference of head of 2 feet between inside and outside levels the seepage inflow would be 24.48 second feet. Thus a pumping capacity of nearly 1 inch in 24 hours would be required to hold down the seepage under the conditions stated and additional capacity would be needed to take care of the rainfall.

"The peat deposit in this 10-acre square probably averaged about 15 inches deep and the borrow-pit ditch around the area was dug to rock. In reclaiming any large body of land underlaid with rock in the shallow peat area, it would be necessary either immediately or within a few years to remove rock to deepen the ditches. This might increase the rate of seepage inflow especially if there is any artesian pressure under the area.

"If any further pumping tests are made on this 10-acre square, it is recommended that rock be first removed to a depth of 2-1/2 feet from the borrow-pit ditch inside the levee and a time chosen when at least 6 inches of water is over the surface outside the levees making it possible to measure the seepage when the difference in level between the inside and outside water is at least 2 feet.

"We will make another test this summer when the ground water is about 1 foot or more above the surface of the ground. We will then excavate the rock from the borrow pit inside the levee and make another test. It is then proposed that we will move the pump to the 10-acre plot located in the Belle Glade area and make a test there under different geological conditions."

Drainage Studies - M. H. Gallatin, Homestead, Florida. - "Water table readings during the latter part of the month were very erratic due to localized rainfall. Well No. 5, which is read daily, has shown some fluctuation due to localized showers.

"At the end of the month a rain of 0.65 inch on the 26th, and 0.15 inch on the 27th gave rises in the water-table wells of approximately 0.10 inch. The rainfall earlier had been very light and it had been the contention of many of the growers that it would take at least an inch or better of water to even saturate the surface. I believe we will have sufficient data within the next year on the fluctuation of or effect of intensity of rainfall at known moisture conditions. As soon as our Wheatstone bridge comes in we will set up a moisture block at the No. 5 well so that we know the moisture conditions. I believe we will then be able to get a better correlation.

"During the month another water-table well was added. This well is south of the No. 1 Well. It is located on the Sub-Tropical Station Highland plots south of Florida City.

"Work on chlorides being carried on by Dr. Westgate indicates that chlorides are still increasing in areas where early contamination was noted. Within the past 2 weeks in the northwest section of Miami, in an area used for the growing of strawberries, chlorides have come in and practically killed out the berries in this area.

"It is hoped that our work can be initiated before the summer rains begin.

"Dr. Westgate of the Sub-Tropical Experiment Station and myself made a rough general survey over the marl lands and we found that in the area east of Allapattah Road there has been a depression in yield due to chlorides encroachment of from 25 - 35 percent. In many fields near the coast entire crops have been lost while in others it has caused a definite depression of growth and yield even in crops such as potatoes and tomatoes which are fairly resistant."

IRRIGATION DIVISION

Evaporation, Transpiration and Seepage Losses Affecting Irrigation Practices - High Plains Area, Texas.-Dean W. Bloodgood selected several farms in the High Plains area as suitable for measurement of irrigation water from wells for wheat, alfalfa, cotton, sorghums, and some vegetable crops. Practically none of the water pumped from wells for irrigation purposes is measured accurately, and the farmers do not know the amount of water being applied to their farms or crops. More than 4,500 pumping plants are being used for the irrigation of over 500,000 acres of land. Additional pumping plants are being installed as rapidly as wells can be drilled. In some areas the plants are spaced so that 10 are within a radius of three-fourths of a mile. The irrigation season for wheat started about the middle of February, being earlier than usual on account of the dry season during the winter months. The capacities of the irrigation plants range from about 450 to 1,800 g.p.m., the average being 700 to 800 g.p.m.

Santa Ana Canyon, Calif.-W. C. Barrett prepared a special report on the methods developed for putting down observation wells for ground-water studies in the sand-gravel aquifer of the Santa Ana Canyon. The importance of this report is probably due to the fact that the aquifer in which the first wells were driven would not allow satisfactory penetration of wells driven with the usual type of equipment, so that quite radical departures in equipment and techniques had to be developed if wells were to be put down to the required depth. The report discusses the factors that led to the types of equipment finally found successful and how these were rigged up and operated.

Analysis of Case-Wheeler Water Problems.-J. S. James concluded his detail to Lincoln on reports of Case-Wheeler projects. Interpretation of climatological data in terms of annual and seasonal moisture deficiency was used in the preparation of these reports. The same method of interpretation is being used by Operations in the analysis of water problems for the District program. Uniform presentations and interpretations were prepared for all Case-Wheeler projects in Region 5. This method gave significant indications when applied to situations in the sub-humid and humid zones. It illustrated and provided at least a rough measure of seasonal-moisture deficiency where annual precipitation is in considerable excess of total annual-moisture requirements. In such cases it shows, and measures approximately, the need for disposal of excess water at certain times as well as the need for supplemental moisture at other times. With such amendments and refinements as may later appear desirable, Mr. James considers that this method may be found to have sufficient value to justify its general adoption.

Efficiency of Irrigation Methods in Problem Areas - Rice Irrigation, Texas.-Dean W. Bloodgood visited one of the irrigated rice-growing areas of Texas near Katy and Brookshire to select rice farms suitable for water-measurement investigations. This area comprises about 30,000

acres of land. The irrigated farms range from 360 to 700 acres. Water is being furnished the farms by plants pumping from ground-water sources. The capacity of the plants visited ranged from 1,500 to 3,500 g.p.m. Electric motors are the chief motive power. The irrigation season for rice will begin about the last of March or middle of April.

Dean W. Bloodgood reports the mimeographing of a report written by the late R. G. Hemphill entitled "Investigation of Irrigation of Rice under Neches Canal in Jefferson County, Texas, in 1926." Approximately 75 copies of this report will be made. They will be available for distribution. There is a strong demand for this information, as it includes data which are still pertinent in directing the efficient irrigation of rice.

Evaporation from Water Surfaces.-A. A. Young reports that 30 evaporation records were tabulated from ground and floating pans in Los Angeles County at elevations from 57 to 6,860 feet above sea level, including latitude and longitude and descriptions of pan locations. Average length of record was 12 years. Differences in evaporation between mountain and desert locations not more than 20 miles apart were as much as 100 percent. These data were obtained from the Los Angeles County Flood Control District which has declared its intention of substituting the Division of Irrigation screened evaporation pan for the type of ground pan used by the District since 1931. Reason for the change is the high coefficient of 0.98 applicable for conversion of annual pan evaporation to equivalent lake or reservoir evaporation.

Length of Run Studies, Imperial Valley, Calif.-While in the Berkeley office, W. W. Donnan read a paper written several years ago by P. E. Fuller, then a member of the Division of Irrigation, on "Uniform Distribution of Irrigation Water," which reported on experiments similar to the length of run studies now being conducted in Imperial Valley. In the current studies, 6-inch and 9-inch Parshall flumes were installed on adjacent 60-foot lands in a 40-acre field on the Ross farm. Length-of-run trials will be made simultaneously on a 1,250-foot length, using 1.5 cubic feet per second on the one land and 3 cubic feet per second on the other. Piezometer records of water tables and moisture samples taken before and after irrigation will complete the data developed in this study. Observations on the 2,600-foot run in young flax fields on the Rood farm were made for comparison with the Ross farm results.

Snow Surveys and Irrigation Water Supply Forecasts.-Personnel assigned to this project have been engaged principally in assembling and publicizing the results of the February snow surveys. In general, prospects are somewhat spotted, previous indications of ample supplies having been considerably altered in several important sections of long-continued dry spells. Definite conclusions as to spring and summer runoff will have to await results of March and April surveys.

Mr. Work reports an episode, typical of snow-survey work, which interfered with one of the contemplated tests but provided another of a different though highly practical nature, as follows:

"One difficult test was to have been a 100-mile run to Kisheneun snow course, a trip which sometimes takes two park rangers 7 days to make. However, it was necessary, in our judgment, to cancel that trip to meet an emergency situation. On the eve of our arrival at Belton, word was received of a Canadian trapper precariously ill with appendicitis at a remote snow-bound ranch on the North Fork of the Flathead River.

"County snow plows with double crews had initiated a desperate attempt to open 45 miles of snow-blocked roads in order to bring the man to Kalispell, Mont., for medical attention. After conferring with the Park Superintendent and with United States Forest Service officials as to the possibility of the roads actually being opened, it appeared imperative in the best interest of all concerned that the man be brought to security with our Sno-Cat. The writer, accompanied by Mr. Frank Folse, District Ranger, U.S.F.S., Kalispell, Mont., left Fish Creek Ranger Station, Glacier Park, at 8:10 a.m. February 8, in the Division of Irrigation Sno-Cat. Traveling over soft unbroken snow on wilderness trails, the machine reached the sick man at Brill's Ranch (45 miles distant) at 3:00 p.m. Serious delays en route due to encounters with moose were experienced. One metal piece in the front end of the machine was broken when an enraged moose disputed the right-of-way with the Sno-Cat. Thirteen such encounters on the round trip reduced the speed of the machine. However, the entire round trip of 90 miles was accomplished in 9 hours 15 minutes of running time and including moose delays.

"Gasoline consumption was 20-1/2 gallons. Oil consumption, zero.

"At the time the Sno-Cat delivered the sick man to a waiting United States Park Service ambulance the snow plows were still at least 25 miles from Brill's Ranch. Emergencies of this sort demonstrate the facility with which agencies such as the Forest Service, Park Service, and Soil Conservation Service have always effected closest cooperation. Officials of both the Forest Service and Park Service extended every facility to expedite the mercy mission.

"The man was brought to safety with every degree of comfort, wrapped in eiderdown bags, and lashed to a Navy wire-basket stretcher suspended by wires in the cab of the Sno-Cat. He claimed that it beat snowshoeing."

Storage of Water Underground for Irrigation - San Joaquin Valley, Calif.-
Dean C. Muckel reports that an operation program for each of the 16 test ponds near Wasco and 13 test ponds near Minter Field was worked out with representatives of the North Kern Water Storage District. Detailed examination was made of the previous percolation-rate curves of each

pond and consideration was given to suggestions received from the various cooperators. In checking over recent results of the Minter Field test ponds it was found that the percolation rates were lower than in previous runs. In a search for the reason, it was discovered that the water of Kern River which supplies these ponds fluctuates considerably in quality during the year. The sodium percentage is high and the hardness low during the fall and winter months. Both are detrimental to percolation.

Broad Study of Extent of Drainage Problems Connected with Irrigation Practices - Soil Moisture Studies, Imperial Valley, Calif.-V. S. Aronovici reports that a laboratory investigation of the efficiency and accuracy of the Toledo Moisture Testure was conducted using four textures and seven moisture levels for each. Some additional checking of the equipment with field samples was made. These results checked with those obtained in the laboratory. In brief, the results show that the Toledo Moisture Testure definitely has a place in soil-moisture work as a guide to irrigation scheduling in irrigated areas. The practical use of the equipment in more detailed irrigation investigations is doubtful, and it would be unreliable in accurate soil-moisture work. Inaccuracies increase with increasingly heavy textures and larger moisture percentages. The equipment is slow when a very large number of samples are required. Several suggested improvements in the equipment were made.

Canal Lining Manual.-Scofield W.C.U. Project, Utah. Wells A. Hutchins and Merlyn E. Modig, Agricultural Economists, S.C.S. completed all reports on the Scofield W.C.U. Project, Price, Utah, and the reports were transmitted to Cyril Luker, Regional Conservator, Region 6, Albuquerque, N. Mex. These reports comprise (a) a short summary report on the indebtedness of Price River Water Conservation District and the interrelationships of irrigation organizations on the Scofield W.C.U. Project; (b) a detailed report entitled "Irrigation Organizations in the Price River Area, Utah, and Their Interrelationships," which describes the development of irrigation in the area, principal irrigation works, water rights and their administration, the incorporated and unincorporated mutual irrigation companies, Price River Water Conservation District, Carbon Water Conservancy District, and the matter of consolidation of the canal companies; (c) an appendix containing articles of incorporation of the mutual companies, notes on an important court ruling with respect to transfers of allotted water, the tripartite and repayment contracts relating to the new Scofield Dam and Reservoir under construction by the Price-Wellington Canal; and (d) additional questions to be asked of the Regional Attorney, Office of the Solicitor. The information required by the Regional Attorney was obtained and presented in the reports. The study disclosed further matters upon which opinions should be obtained from the Regional Attorney before proceeding with a program of long-term loans. It would be desirable to know whether lands to which the county has taken tax deeds are relieved from all liability with respect

to district bond assessments; what effect the taking of tax deeds has upon the water allotments of the tracts so affected; what effect the limitation statute on contest of tax deeds has upon the necessity or desirability of quiet title actions; and whether and to what extent the statute of limitations applies to actions upon district bonds and coupons. The county has taken tax deeds on a large proportion of tracts to which district water was allotted; and a large proportion of unpaid district bonds and coupons is now outlawed if the statute applies to such obligations. The answers to these queries will affect, in large measure, the matter of long-term loans in various parts of the irrigation district.

4-10-46

